

**Fishery Data Series No. 00-35**

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**Surveys of the 1998 Coho Salmon and 1999 Chinook  
Salmon Sport Fisheries in the lower Kanektok  
River, Alaska**

by

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and

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**December 2000**

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**Alaska Department of Fish and Game**

**Division of Sport Fish**



## Symbols and Abbreviations

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Weights and measures (metric)		General		Mathematics, statistics, fisheries	
centimeter	cm	All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis	$H_A$
deciliter	dL	All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	e
gram	g	and	&	catch per unit effort	CPUE
hectare	ha	at	@	coefficient of variation	CV
kilogram	kg	Compass directions:		common test statistics	F, t, $\chi^2$ , etc.
kilometer	km	east	E	confidence interval	C.I.
liter	L	north	N	correlation coefficient	R (multiple)
meter	m	south	S	correlation coefficient	r (simple)
metric ton	mt	west	W	covariance	cov
milliliter	ml	Copyright	©	degree (angular or temperature)	°
millimeter	mm	Corporate suffixes:		degrees of freedom	df
<b>Weights and measures (English)</b>		Company	Co.	divided by	÷ or / (in equations)
cubic feet per second	ft <sup>3</sup> /s	Corporation	Corp.	equals	=
foot	ft	Incorporated	Inc.	expected value	E
gallon	gal	Limited	Ltd.	fork length	FL
inch	in	et alii (and other people)	et al.	greater than	>
mile	mi	et cetera (and so forth)	etc.	greater than or equal to	≥
ounce	oz	exempli gratia (for example)	e.g.,	harvest per unit effort	HPUE
pound	lb	id est (that is)	i.e.,	less than	<
quart	qt	latitude or longitude	lat. or long.	less than or equal to	≤
yard	yd	monetary symbols (U.S.)	\$, ¢	logarithm (natural)	ln
Spell out acre and ton.		months (tables and figures): first three letters	Jan,...,Dec	logarithm (base 10)	log
<b>Time and temperature</b>		number (before a number)	# (e.g., #10)	logarithm (specify base)	log <sub>2</sub> , etc.
day	d	pounds (after a number)	# (e.g., 10#)	mideye-to-fork	MEF
degrees Celsius	°C	registered trademark	®	minute (angular)	'
degrees Fahrenheit	°F	trademark	™	multiplied by	x
hour (spell out for 24-hour clock)	h	United States (adjective)	U.S.	not significant	NS
minute	min	United States of America (noun)	USA	null hypothesis	$H_0$
second	s	U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	percent	%
Spell out year, month, and week.				probability	P
<b>Physics and chemistry</b>				probability of a type I error (rejection of the null hypothesis when true)	$\alpha$
all atomic symbols				probability of a type II error (acceptance of the null hypothesis when false)	$\beta$
alternating current	AC			second (angular)	"
ampere	A			standard deviation	SD
calorie	cal			standard error	SE
direct current	DC			standard length	SL
hertz	Hz			total length	TL
horsepower	hp			variance	Var
hydrogen ion activity	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

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by

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## ABSTRACT

Surveys were conducted on the sport fisheries for coho *Oncorhynchus kisutch* and chinook *O. tshawytscha* salmon of the lower Kanektok River in Southwest Alaska. The coho salmon fishery was surveyed from 7-25 August 1998 and the chinook salmon fishery was surveyed from 18 June-20 July 1999. Anglers were interviewed for information on catch, effort and use of guide services and demographic characteristics. Age, sex, length and weight data were collected from coho and chinook salmon harvested by anglers.

During the coho salmon survey 702 anglers were interviewed for which the overall catch per unit effort of coho salmon was 1.84 (SE = 0.06) fish/h. Of those anglers, 56% were guided and 92% were not residents of Alaska. Approximately 58% of the anglers used fly fishing gear, while 29% used spinning tackle. Of the 255 coho salmon sampled, the average length was 615 mm (SE = 2.2) and the average weight 4.2 kg (SE = 0.1). Age-2.1 coho salmon comprised 85% of the coho salmon sampled.

During the chinook salmon survey 1,246 anglers were interviewed and the overall catch per unit effort of chinook salmon was 0.25 (SE = 0.01) fish/h. Of 1,246 anglers, equal proportions (48%) were guided and unguided. Approximately 91% of the anglers were not residents of Alaska. Most interviewed anglers used spinning (49%) or fly tackle (44%). The average length of the 95 chinook salmon measured was 749 mm (SE = 15) and the average weight of 84 weighed fish was 7.5 kg (SE = 0.4). Among 89 aged fish, the predominant age group was age 1.4 (56%), while age-1.3 fish comprised 22.5%.

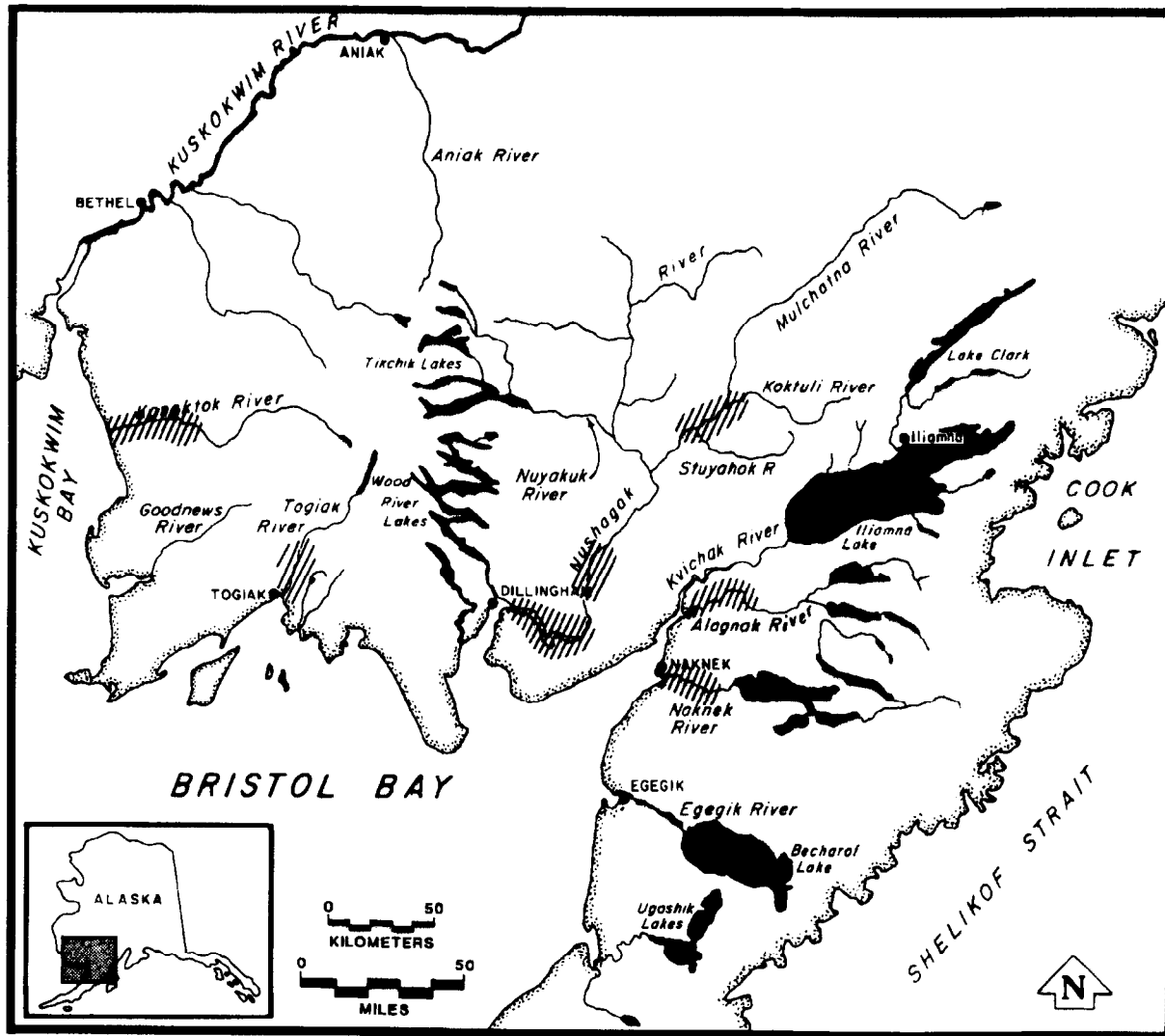
Key words: coho salmon, *Oncorhynchus kisutch*, chinook salmon, *Oncorhynchus tshawytscha*, Kanektok River, catch rates, angler characteristics, biological composition.

## INTRODUCTION

The Kanektok River, located 112 km (70 miles) south of the community of Bethel in the Togiak National Wildlife Refuge (Figure 1) supports significant fisheries for a variety of species. Based on the department's annual mail survey, the Kanektok River is one of the top five destinations for anglers in the Southwest Management Area (Howe et al. 1995-1998). The Kanektok River sustains runs of all five species of North American Pacific salmon and is particularly well known as an outstanding coho *Oncorhynchus kisutch* and chinook salmon *O. tshawytscha* fishery. The Kanektok River coho and chinook salmon runs also provide subsistence and commercial harvests for the residents of the community of Quinhagak and the Kuskokwim Bay area (Tables 1 and 2).

The sport fishery for coho and chinook salmon occurs primarily in the lower 16 km of the river (Figure 2). The fishery experienced rapid growth in the 1980s with 8,114 angler-days expended in 1998 (Howe et al. 1999, revised estimate).

The effects of sport anglers on fish populations, water quality, and land use have become sources of concern on the Kanektok River. In 1997, the Alaska Board of Fisheries addressed some of these concerns by changing several regulations, including restricting anglers to unbaited single-hook artificial lures all year and establishing an angling closure to protect spawning chinook salmon. In addition, the U.S. Fish and Wildlife Service (USF&WS) is reviewing its public use policies throughout Refuge lands. The policies developed during this review process may affect angling practices and opportunities on the Kanektok River. To preserve angling opportunity and properly manage the sport fisheries, surveys to monitor changes in use are required periodically. The coho and chinook salmon fisheries in the lower Kanektok River were last surveyed in 1991 and 1994 (Dunaway and Bingham 1992; Dunaway and Fleischman 1995).



**Figure 1.-Popular coho and chinook salmon fisheries in the Southwestern Alaska Management Area.**

The objectives for the 1998 survey of the coho salmon and 1999 chinook salmon fishery in the lower Kanektok River were to:

1. Estimate the weekly and overall catch per unit effort (CPUE);
2. Describe angler characteristics by terminal tackle type (flies, bait, or lures) and angler-type (resident or nonresident; guided, unguided or guides);
3. Index daily angler effort during each sampled day; and
4. Estimate the age, sex, length and weight compositions of coho and chinook salmon harvested by the sport fishery in each survey area.



**Table 1.-Coho salmon commercial, subsistence, and sport harvest plus escapement for the Kanektok River fishery, 1983 to 1998.**

Year	Harvest			Escapement Index <sup>d</sup>	Total Run <sup>e</sup>
	Commercial <sup>a</sup>	Subsistence <sup>b</sup>	Sport <sup>c</sup>		
1983	32,442		367		
1984	132,151		1,895	46,830	180,876
1985	29,992		622		
1986	57,544		2,010		
1987	50,070		2,300	20,056	72,426
1988	68,605	4,317	1,837		
1989	44,607	3,787	1,096	f	
1990	26,926	4,174	644		
1991	42,571	3,232	358	4,330	50,491
1992	86,404	2,958	275		
1993	55,817	2,152	734		
1994	83,912	2,739	675		
1995	66,203	2,561	970		
1996	118,718	1,467	875	23,656 <sup>g</sup> <sup>h</sup>	144,716
1997	32,862	1,264	1,220	23,166 <sup>i</sup>	58,512
All Years Avg.	61,922	2,865	1,059	23,608	101,404
Percent	95%	4%	2%		
1993 to 1997	71,502	2,037	895	23,411	101,614
Percent	96%	3%	1%		
1998	80,183	1,702	751		
Percent	97%	2%	1%		

<sup>a</sup> Quinhagak (District 4) commercial harvest (Burkey et al. 2000, Appendix C3).

<sup>b</sup> Subsistence harvests by the community of Quinhagak (Burkey et al. 2000, Appendix A12).

<sup>c</sup> Source: SWHS for the Kanektok River, Mills 1984-1994 and Howe et al. 1995-1999. 1996-1998 estimates presented here are revised estimates.

<sup>d</sup> Unexpanded observed count made from fixed-wing aircraft between 20 August and 5 September. Source: Burkey et al. 2000, Appendix C4.

<sup>e</sup> Considered a minimum because escapement estimates are unexpanded.

<sup>f</sup> In 1989 a survey flown early, on 25 July, counted 1,755 coho salmon (Aerial survey notebook, Commercial Fisheries Division, Bethel).

<sup>g</sup> In 1995, a survey flown early, on 14 August, counted 2,900 coho salmon (Aerial survey notebook, Commercial Fisheries Division, Bethel).

<sup>h</sup> 1996 escapement survey was partial due to poor conditions.

<sup>i</sup> 1997 escapement estimate is based on tower count ending 21 August; aerial survey conditions poor. Aerial survey count of coho salmon on 1 October past the peak of the return was 5,162 (Burkey et al. 2000).

**Table 2.-Chinook salmon commercial, subsistence, and sport harvest plus escapement for the Kanektok River fishery, 1960 to 1998.**

Year	Harvest				Escapement	Total Run <sup>c</sup>
	Commercial <sup>a</sup>	Subsistence <sup>b</sup>	Sport <sup>c</sup>	Total	Index <sup>d</sup>	
1960	0			0	6,047	6,047
1961	4,328			4,328		
1962	5,526			5,526	935	6,461
1963	6,555			6,555		
1964	4,081			4,081		
1965	2,976			2,976		
1966	278			278	3,718	3,996
1967	0	1,349		1,349		
1968	8,879	2,756		11,635	4,170	15,805
1969	16,802			16,802		
1970	18,269			18,269	3,112	21,381
1971	4,185			4,185		
1972	15,880			15,880		
1973	14,993			14,993	814	15,807
1974	8,704			8,704		
1975	3,928			3,928		
1976	14,110			14,110		
1977	19,090	2,012		21,102	5,787	26,889
1978	12,335	2,328		14,663	19,180	33,843
1979	11,144	1,420		12,564		
1980	10,387	1,940		12,327	6,172	18,499
1981	24,524	2,562		27,086	15,900	42,986
1982	22,106	2,402		24,508	8,142 <sup>f</sup>	32,650
1983	46,385	2,542	1,511	50,438	8,890	59,328
1984	33,633	3,109	922	37,664	12,182	49,846
1985	30,401	2,341	672	33,414	13,465	46,879
1986	22,835	2,682	938	26,455	3,643	30,098
1987	26,022	3,663	508	30,193	4,223	34,416
1988	13,883	3,690	1,910	19,483	11,140	30,623
1989	20,820	3,542	884	25,246	7,914	33,160
1990	27,644	6,013	503	34,160	2,563	36,723
1991	9,480	3,693	316	13,489	2,100	15,589
1992	17,197	3,447	656	21,300	3,856	25,156
1993	15,784	3,368	1,006	20,158	4,670	24,828
1994	8,564	3,995	751	13,310	7,386	20,696
1995	38,584	2,746	739	42,069		
1996	14,165	3,075	728	17,968	6,107	24,075
1997	35,510	3,433	1,632	40,575	8,080	48,655
All Years Average	15,526	2,961	912	18,156	6,808	28,177
Percent	86%	16%	5%			
1993 to 1997 Avg.	22,521	3,323	971	26,816	6,561	29,564
Percent	84%	12%	4%			
1998	23,158	4,041	1,475	28,674		
Percent	81%	14%	5%			

<sup>a</sup> Quinhagak District commercial harvest. Source: Burkey et al. 2000, Appendix C3.

<sup>b</sup> Subsistence harvest by the community of Quinhagak. Source: Burkey et al. 2000, Appendix A12.

<sup>c</sup> Source: SWHS, Mills 1984-1994, Howe et al. 1995-1999. 1996-1998 estimates presented here are revised estimates.

<sup>d</sup> Unexpanded observed counts made from fixed-wing aircraft between 20 July and 5 August. Source: Burkey et al. 2000, Appendix C4.

<sup>e</sup> Considered a minimum because escapement is unexpanded.

<sup>f</sup> 1982 escapement survey after August 5, late for chinook salmon.

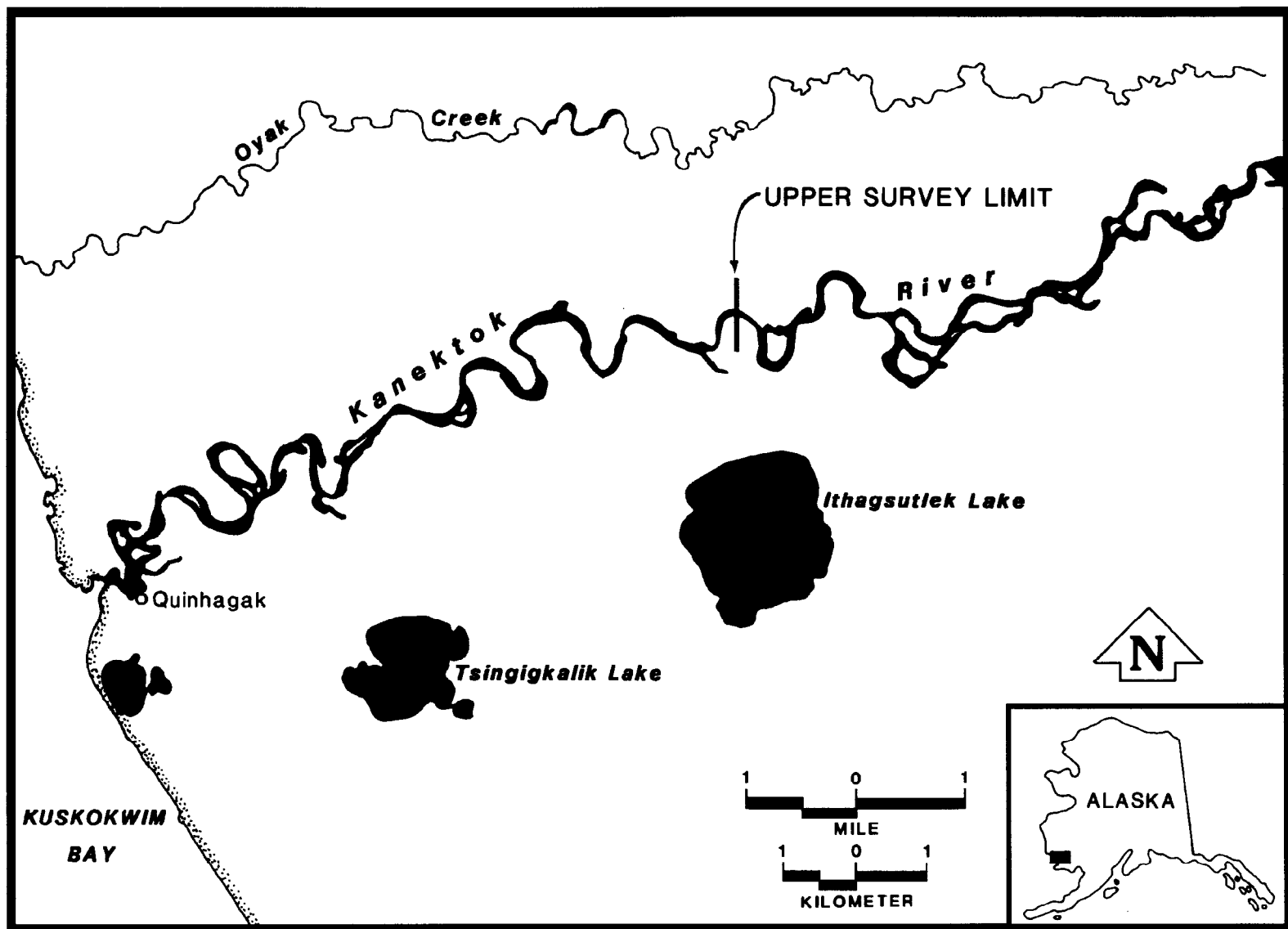


Figure 2.-Kanektok River coho and chinook salmon angler survey site.

## METHODS

### STUDY DESIGN

Systematic surveys of the coho and chinook salmon sport fisheries were conducted along the lower Kanektok River from the village of Quinhagak to a point approximately 16 km upstream (Figure 2). The coho salmon survey began 7 August and ended 25 August 1998 and the chinook salmon survey was conducted from 18 June through 20 July 1999. Sampling of the coho and chinook salmon fisheries occurred 5 days per week (Friday through Tuesday), from 1100 to 1930 hours. Each day, the technician spent about 7 hours conducting angler interviews (complete and incomplete trips) and collecting biological data from sport-harvested chinook salmon encountered, and about 1.5 hours conducting the angler count.

The schedule for collecting interviews and conducting counts was selected to correspond to seasonal, weekly and daily peaks in the sport fishery determined from previous surveys (Dunaway and Bingham 1992; Dunaway and Fleischman 1995) and unpublished crew leader reports. To obtain a representative sample of all anglers, the sample days were selected to access weekend anglers (typically using float trips or fly-ins) and weekday anglers (characterized as using local lodges).

### CPUE as an Index of Abundance

This survey design and corresponding schedule were directed at obtaining a consistent proportional sample of the fishery throughout the progression of the survey. Accordingly, "weekly" estimates of CPUE should be unbiased as indices of abundance of salmon as they pass through the fishery (Bernard et al. 1998)<sup>1</sup>, therefore it is expected that the estimates of CPUE are reflective of gross changes in fish abundance (with the usual proviso that catchability remains constant)<sup>2</sup>. However, estimates of CPUE are not expected to be unbiased estimates of the catch rate of the fishery as a whole, because not all days of the week and all hours of the angling day were sampled with equal probability.

Interviews were obtained by roving the fishery, which can result in "length of stay" (LOS) bias. The bias could be substantial because the probability of interviewing anglers is proportional to the length of their daily fishing trip. The duration of the trip can be affected by the daily bag limit, which may result in an arrest of angling when achieved. However, the likelihood of severe LOS bias and its affects are ameliorated because the Kanektok River fishery is remote, which results in trips of specific duration due to travel constraints. Therefore, anglers tend to switch to catch-and-release fishing or different species after filling their bag limits. However, the estimates of CPUE may not accurately reflect overall catch rates because the entire fishing day is not covered and exit locations and methods of access are extensive.

### Angler Effort Index

One angler count was conducted each day at the same time. These counts will represent an unbiased index of the angler effort during the days and time sampled if the distribution of angler

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<sup>1</sup> With the proviso that catchability of the salmon remains constant throughout the course of the fishery.

<sup>2</sup> Estimates of CPUE as an index of abundance may be calculated separately for anglers who use guides versus anglers who do not use guides. These two types of anglers typically exhibit substantial differences in catch rates. If the make-up of the fishery in terms of guided versus unguided anglers changes through the course of the survey, then estimates of CPUE that ignore this distinction will not accurately reflect changes of fish abundance.

effort throughout the sampling day does not vary during the course of the survey. Accordingly, the count was not used to estimate angler effort for the fishery since all possible count times were not surveyed.

### **Angler Characteristics**

Since all angling days were not covered, data describing the composition of angler-trips (by terminal gear use and angler-type) were expected to be reflective of the fishery only on the sampled days and periods. If different types of anglers fish during the days of the week and/or during the hours of the day not sampled, then estimates of angler-trips by angler-type will not be representative of the whole fishery.

## **DATA COLLECTION**

### **Angler Interviews**

The technician on duty traveled (roved) throughout the fishery via motorboat to conduct interviews and count all anglers participating in the fishery. Interviews were conducted from 1100-1930 excluding time used for angler counts. Interviews consisted of obtaining catch, harvest, effort (time duration), angler-type (guided, unguided, guides), terminal tackle, and general demographic information from anglers encountered in the fishery.

Both complete-trip (anglers who had suspended fishing for the day) and incomplete-trip interviews were collected. Technicians attempted to distribute their interview effort uniformly among all angling groups and throughout the survey area. Effort was made to interview a high proportion (> 70%) of the anglers present on a given sampling day.

### **Angler Counts**

A single daily angler count was used to index fishing effort. Angler counts took no more than 70 minutes, and were considered instantaneous and representative of angler effort when conducted. The starting time for the daily count was 11:00 a.m. for the 1998 coho salmon survey and 2:00 p.m. for the 1999 chinook salmon survey.

The technician counted all active anglers while driving the boat at a constant rate of speed through the fishery. Active anglers are individuals who are fishing and includes those handling rods and tackle, repositioning a boat, landing a fish, repairing gear or assisting another angler. Active anglers did not include people solely operating boats, eating lunch or engaging in other activities not associated with angling.

### **Biological Sampling of Harvested Fish**

Sport harvested coho and chinook salmon encountered during the angler interviews were sampled for age, sex, length and weight data. When possible, all coho and chinook salmon retained by interviewed anglers were sampled (i.e., no subsampling of the creel). The sampling design is expected to yield a proportional sample of the harvest through the progression of the fishery (i.e., equal proportion of the harvest). The resultant data were treated as if collected from a simple random sample.

Harvested coho and chinook salmon were measured to the nearest millimeter for mid-eye to fork-of-tail length, weighed to the nearest 0.1 kg for coho salmon and 0.25 kg for chinook and

sexed based on external characteristics. In addition, three scales were removed from the preferred area<sup>3</sup> and mounted on an adhesive-coated card. Standard age determination procedures were used (see Jerald 1983 for a general description of the principles used). The European system of age designation was used, where the number of freshwater winter annuli precedes the decimal and the number of marine winter annuli follows. Total age from the brood year is the sum of the two numerals plus one.

## DATA ANALYSIS

### Catch Rate

Overall and weekly estimates of CPUE were calculated according to the procedures outlined below. All of the individual angler interview data collected during the 5 days sampled in a week were combined to obtain these estimates. The first step involved calculating the CPUE for each angler interviewed:

$$cpue_{hi} = \frac{c_{hi}}{e_{hi}}, \quad (1)$$

where,  $c_{hi}$  equals the number of fish caught (both kept and released) by the  $i^{th}$  angler interviewed during the  $h^{th}$  week of the survey, and  $e_{hi}$  is the effort of the angler.

Then the weekly mean estimate of CPUE is simply:

$$\overline{cpue}_h = \frac{\sum_{i=1}^{m_h} cpue_{hi}}{m_h}, \quad (2)$$

where,  $m_h$  equals the number of anglers interviewed within each week of the survey.

Estimates of the variance of the mean CPUE estimates were calculated as follows:

$$\hat{V}[\overline{cpue}_h] = \frac{\sum_{i=1}^{m_h} (cpue_{hi} - \overline{cpue}_h)^2}{m_h(m_h - 1)}, \quad (3)$$

and SE was calculated as the square root of the variance. Confidence intervals (95%) were calculated to compare CPUE from week to week.

### Angler Effort

As noted above, the single angler count conducted each day represents an index of angler effort, and no analysis was performed.

### Angler Characteristics

The proportion of angler-trips as defined by the categories of terminal gear type use and/or angler-type (e.g., guided versus unguided) was calculated as:

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<sup>3</sup> The left side of the fish approximately two rows above the lateral line and on a diagonal line downward from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (Scarnecchia 1979 and Welander 1940).

$$p_z = \frac{m_z}{m}, \quad (4)$$

where  $m_z$  equals the number of the interviewed anglers whose trips were categorized as  $z$ ; and  $m$  equals the total number of classifiable anglers interviewed.

No estimates of the sampling variance were calculated, since these proportions are merely descriptive in nature and can not be used to make inferences about the fishery.

### Assumptions

The assumptions necessary for unbiased point and variance estimates for the various parameters obtained by the procedures outlined above include the following:

1. Interviewed anglers accurately reported their fishing time and the number of fish by species kept and released;
2. The technician accurately classified anglers and the interviewed anglers accurately reported their residency, trip type (guided, unguided), and the terminal gear type used during their fishing trip;
3. Catch rate and duration of fishing trip were independent (necessitated by the use of a roving method of interviewing—anglers with longer fishing trips have a greater probability of being intercepted for interview);
4. The distribution of angler effort within the angling day did not vary substantially during the course of the survey (necessary for CPUE to be an unbiased index of fish abundance, and for the single angler count to be an unbiased index of angler effort); and
5. Catchability of the salmon did not vary substantially during the course of the survey (necessary for CPUE to be an unbiased index of fish abundance).

There are no direct ways of evaluating or testing any of the assumptions. For assumptions 1 and 2, anglers are expected to have fairly good recollection of the total number of fish caught and to accurately report their fishing trip characteristics. Validation of assumptions 3, 4 and 5 were addressed previously (see subsection: CPUE as an Index of Abundance, above).

### Biological Composition

The proportion of harvested coho or chinook salmon that were age  $u$  was estimated as:

$$\hat{p}_u = \frac{n_u}{n}, \quad (5)$$

where  $n_u$  equals the number of the sampled coho or chinook salmon harvested that were age  $u$ ; and  $n$  equals the total number of coho and chinook salmon sampled.

For samples collected,  $\hat{V}[\hat{p}_u]$  was calculated without the finite population correction factor, since we do not have harvest estimates:

$$\hat{V}[\hat{p}_u] = \frac{\hat{p}_u(1 - \hat{p}_u)}{n - 1}, \quad (6)$$

and SE was calculated as the square root of the variance. Mean length-at-age and mean weight of harvested coho and chinook salmon were estimated, following standard procedures (Sokal and Rohlf 1981, Boxes 4.2 and 7.1, pages 56 and 139).

Data files and computer programs used to produce this report are listed in Appendix B1.

## RESULTS

### COHO SALMON FISHERY

#### Catch Rates and Angler Counts

From 702 interviews collected during the lower Kanektok River coho salmon survey, the overall average CPUE of coho salmon was 1.84 (SE = 0.06) fish/h and ranged from 1.18 (SE = 0.07) fish/h during week one to 2.26 (SE = 0.11) fish/h during week three (Table 3). Angler counts ranged from 12 on 7 August to a peak of 41 on 9 August (Appendix A1).

#### Angler Characteristics

Among 702 interviews, 56% percent of the anglers were guided and 41% were unguided (Table 4). Non-Alaska residents comprised 92% of the anglers and non-U.S. residents were not encountered. Male anglers accounted for approximately 95% of all interviews. Most of the anglers in the lower Kanektok River used fly fishing gear (58%) or spinning gear (29%).

#### Biological Composition

Among 230 harvested coho salmon (Table 5), males comprised 75.7% (SE = 2.8) of the harvest and females 22.2% (SE = 2.7), while the sex of 2.2% (SE = 1.0) of the coho salmon sampled could not be determined (Table 5). The predominant age group among all fish sampled was age 2.1 (84.8%; SE = 2.4), while age-1.1 coho salmon comprised 13.5% (SE = 2.3) of the sample. Overall average length of 255 fish was 615 mm (SE = 2.2) and overall average weight of 218 fish was 4.2 kg (SE = 0.1). The largest fish sampled was 685 mm long, weighed 5.7 kg and was caught on 22 August. Anglers also caught pink salmon, Dolly Varden, rainbow trout and chum salmon (Appendix A3).

**Table 3.-Catch per unit effort for the coho salmon sport fishery in the lower Kanektok River, 7-25 August 1998.**

Temporal Component	Sample Size	CPUE <sup>a</sup>	SE	95% Confidence Interval	
				Lower	Upper
1 (07-13 August)	246	1.18	0.07	1.05	1.31
2 (14-20 August)	191	2.09	0.13	1.84	2.34
3 (21-25 August)	265	2.26	0.11	2.05	2.47
Entire Season	702	1.84	0.06	1.72	1.95

<sup>a</sup> Number of fish caught per angler-hour of effort.



**Table 4.-Number and percent of angler trips by angler and gear type during the coho salmon sport fishery on the lower Kanektok River, 7-25 August 1998.**

Characteristic	Angler Trips	Percent
<b>ANGLER TYPE</b>		
Guided	393	56
Unguided	287	41
Guide who is fishing	21	3
Unknown	1	0
<b>RESIDENCY</b>		
Alaskan Residents	44	6
Local Alaskan Residents <sup>a</sup>	20	3
Nonlocal Alaskan Residents <sup>b</sup>	24	4
Non-Alaskan Residents	648	92
U.S. Resident	648	92
Non-U.S. Resident	0	0
Residency unknown	10	1
<b>GENDER</b>		
Male	665	95
Female	29	4
Gender unknown	8	1
<b>TACKLE TYPE</b>		
Lures	204	29
Fly	408	58
Lures and Fly	81	12
Unknown	11	2
Total Angler Trips	702	

<sup>a</sup> Alaskan resident living in Quinhagak area.

<sup>b</sup> All other Alaskan residents.

**Table 5.-Mean lengths (millimeters) and weights (kilograms) of coho salmon, by sex and age group, from samples collected from the lower Kanektok River sport harvest, 7-25 August 1998.**

		Age Group				Total
	Unknown	1.1	1.2	2.1	2.2	
<b>Females</b>						
Percent		3		19	0	22
SE		1		3	0	3
Sample size		6		44	1	51
Mean length	600	592		607	579	604
SE	19	10		4		4
Sample size	5	6		43	1	55
Mean weight	3.8	3.4		3.8	3.8	3.8
SE	0.3	0.2		0.1		0.1
Sample size	5	6		38	1	50
<b>Males</b>						
Percent		10	0	64	1	76
SE		2	0	3	1	3
Sample size		24	1	147	2	174
Mean length	617	619	658	620	548	619
SE	7	8		3	3	2
Sample size	21	24	1	146	2	194
Mean weight	4.4	4.2		4.4	3.3	4.4
SE	0.2	0.2		0.1	0.3	0.1
Sample size	20	19		121	2	162
<b>All Samples</b>						
Percent		14	0	85	1	100
SE		2	0	2	1	0
Sample size		31	1	195	3	230
Mean length	612	614	658	616	558	615
SE	7	7		2	11	2
Sample size	27	31	1	193	3	255
Mean weight	4.2	4.0		4.2	3.5	4.2
SE	0.2	0.2		0.1	0.2	0.1
Sample size	26	26		163	3	218

## CHINOOK SALMON FISHERY

### Catch Rates and Angler Counts

From the 1,246 interviews conducted during the lower Kanektok river chinook salmon study, the overall average CPUE of chinook salmon was 0.25 (SE = 0.01) fish/h and ranged from 0.17 (SE = 0.02) to 0.39 (SE = 0.02) fish/h (Table 6). Angler counts ranged from a peak of 65 on 28 June and 2 July to a low of 15 on 16 July (Appendix A2).

### Angler Characteristics

Among 1,246 interviews, an equivalent proportion of anglers were guided and unguided anglers (48%; Table 7). Non-Alaskan residents comprised 91% of the interviewed anglers, while 15% were residents of some other country. Males accounted for 97% of anglers interviewed. Anglers in the lower Kanektok River used spinning (49%) or fly tackle (44%) in similar proportions, and approximately 7% of the anglers used a combination of spinning and fly fishing gear.

**Table 6.-Catch per unit effort for the chinook salmon sport fishery in the lower Kanektok River, 18 June-20 July 1999.**

Temporal Component	Sample		SE	95% Confidence Interval	
	Size	CPUE <sup>a</sup>		Lower	Upper
1 (18-24 June)	251	0.17	0.02	0.13	0.22
2 (25 June-01 July)	363	0.39	0.02	0.34	0.44
3 (02-08 July)	267	0.23	0.02	0.19	0.27
4 (09-15 July)	211	0.17	0.02	0.14	0.21
5 (16-22 July)	154	0.17	0.05	0.06	0.28
Entire Season	1,246	0.25	0.01	0.22	0.27

<sup>a</sup> Number of fish caught per angler-hour of effort.

### Biological Composition

Among 89 harvested chinook salmon (Table 8), males comprised 73.0% (SE = 4.7) and females 27% (SE = 4.7) of the harvest. The predominant age group among all fish sampled was age 1.4 (56.2%; SE = 5.3), while age-1.3 chinook salmon comprised 22.5% (SE = 4.4) of the sample. Of 95 measured fish, overall average length was 749 mm (SE = 14.6) and overall average weight of 84 weighed fish was 7.5 kg (SE = 0.4). The largest fish sampled was 1,033 mm long, weighed 17.6 kg and was captured on 26 June. Anglers also caught 2,281 chum salmon (Appendix A4).

**Table 7.-Number and percent of angler trips by angler and gear type during the chinook salmon sport fishery on the lower Kanektok River, 18 June-20 July 1999.**

Characteristic	Angler	
	Trips	Percent
<b>ANGLER TYPE</b>		
Guided	602	48
Unguided	603	48
Guide who is fishing	35	3
Unknown	6	1
<b>RESIDENCY</b>		
Alaskan Residents	113	9
Local Alaskan Residents <sup>a</sup>	48	4
Nonlocal Alaskan Residents <sup>b</sup>	65	5
Non-Alaskan Residents	1,133	91
U.S. Resident	947	76
Non-U.S. Resident	186	15
<b>GENDER</b>		
Male	1,214	97
Female	32	3
<b>TACKLE TYPE</b>		
Spin	608	49
Fly	543	44
Spin and Fly	92	7
Unknown	3	0
Total Angler Trips	1,246	

<sup>a</sup> Alaskan resident living in Quinhagak area.

<sup>b</sup> All other Alaskan residents.

**Table 8.-Mean lengths (millimeters) and weights (kilograms) of chinook salmon, by sex and age group, from samples collected from the lower Kanektok River sport harvest, 18 June-20 July 1999.**

		Age Group						
	Unknown	1.2	1.3	1.4	1.5	2.2	2.3	Total
<b>Females</b>								
Percent			3	23	1			27
SE			2	4	1			5
Sample size			3	20	1			24
Mean length	838		782	859	875			849
SE			23	12				11
Sample size	1		3	20	1			25
Mean weight			7.8	10.1	10.6			9.8
SE			0.3	0.5				0.5
Sample size			3	15	1			19
<b>Males</b>								
Percent		16	19	34	2	1	1	73
SE		4	4	5	2	1	1	5
Sample size		14	17	30	2	1	1	65
Mean length	676	534	679	820	869	515	620	713
SE	37	15	26	18	106			18
Sample size	5	14	17	30	2	1	1	70
Mean weight	5.1	3.1	5.8	9.5	10.8	2.1	4.1	6.5
SE	0.8	0.7	0.7	0.7	3.4			0.5
Sample size	5	13	16	27	2	1	1	65
<b>All Samples</b>								
Percent		16	23	56	3	1	1	100
SE		4	4	5	2	1	1	
Sample size		14	20	50	3	1	1	89
Mean length	703	534	695	836	871	515	620	749
SE	41	15	23	12	61			15
Sample size	6	14	20	50	3	1	1	95
Mean weight	5.1	3.1	6.1	9.7	10.7	2.1	4.1	7.5
SE	0.8	0.7	0.6	0.5	2.0			0.4
Sample size	5	13	19	42	3	1	1	84

## **DISCUSSION**

### **COHO SALMON FISHERY**

Although the study design for the 1998 survey of the Kanektok River coho salmon fishery was different from previous surveys in 1991 and 1994 (Dunaway and Bingham 1992; Dunaway and Fleischman 1995), several statistics are comparable. These statistics include catch rates, angler characteristics (Table 9) and biological composition of the sport harvest (Table 5). Catch rates of coho salmon were relatively consistent among the three studies. In 1998, the catch rate of coho salmon was 1.8 fish/h compared to 1.7 and 2.2 fish/h in 1991 and 1994, respectively.

The proportions of guided and unguided anglers were similar during the 1994 and 1998 surveys, but differed substantially from those observed in the 1991 survey (Table 9). Guided anglers comprised 52% of anglers interviewed in 1994 and 56% in 1998. In contrast, only 37% of anglers interviewed during the 1991 study were guided. The proportion of non-resident anglers was also similar, accounting for 87%, 90% and 92% of the angler interviews in 1991, 1994 and 1998, respectively.

The age composition of coho salmon sampled during angler interviews was consistent between the 1994 and 1998 surveys. Age-2.1 coho salmon were the predominant age class, comprising more than 80% of the observed fish. The average length and weight of sampled coho salmon were also similar in 1994 and 1998. The mean length and weight in 1994 was 608 mm and 3.9 kg and in 1998 was 615 mm and 4.2 kg.

### **CHINOOK SALMON FISHERY**

The study design for the 1999 chinook salmon survey on the lower Kanektok River also differed from the 1991 and 1994 surveys (Dunaway and Bingham 1992; Dunaway and Fleischman 1995). Although the methods are not the same, relative comparisons can be made about catch rates, angler characteristics (Table 10) and biological composition among the three studies (Table 8). The catch rate of chinook salmon during the 1999 study was approximately 50% lower than in 1991 and 1994. In 1999, anglers caught 0.25 fish/h compared to 0.5 fish/h in 1991 and 0.6 fish/h in 1994. The decline in catch rates was not extraordinary as chinook salmon runs were depressed throughout southwest Alaska in 1999.

Angler characteristics for 1999 differed from 1991 and 1994 survey results. The percentage of guided anglers increased from 32% in 1994 to 48% in 1999, but was less than in 1991 (62%). The proportion of non-resident anglers also increased from approximately 76% of angler interviews in 1991 and 1994 to 91% in 1999 (Table 10).

The biological composition of chinook salmon harvested in the sport fishery differed between 1999 and 1994 surveys. This change is largely due to a decrease in the proportion of age-1.3 chinook salmon. In 1994, age-1.3 fish comprised approximately 36% of the samples compared to 23% in 1999. Age-1.4 fish were the predominant age class in both studies, accounting for approximately 56% of the samples each year.

**Table 9.-Comparison of catch rates, angler characteristics and gear selection observed during surveys of the coho salmon sport fishery in the lower Kanektok River.**

Parameter	Survey Year		
	1991 <sup>a</sup>	1994 <sup>b</sup>	1998
Survey Dates	8/7 to 8/27	8/5 to 8/23	8/7 to 8/25
Total Interviews	260	585	703
Completed-trip Interviews	166	434	362
Catch Rate	1.7	2.2	1.8
<b>Percentage of Angler-trips</b>			
<b>ANGLER TYPE</b>			
Guided	37	52	56
Unguided	62	48	41
Guide who is fishing			3
Unknown			0
<b>RESIDENCY</b>			
Non-Alaskan Residents	87	90	92
Alaskan Residents	13	10	6
Residency unknown			1
<b>TACKLE TYPE</b>			
Spin	49	28	29
Fly	14	59	58
Spin and Fly	30	8	12
Spin, Fly and Bait <sup>c</sup>		<1	
Spin and Bait		2	
Bait		3	
No Record	8		2

<sup>a</sup> Dunaway and Bingham 1992.

<sup>b</sup> Dunaway and Fleischman 1995.

<sup>c</sup> Use of bait was prohibited in 1998.

**Table 10.-Comparison of catch rates, angler characteristics and gear selection observed during surveys of the chinook salmon sport fishery in the lower Kanektok River.**

Parameter	Survey Year		
	1991 <sup>a</sup>	1994 <sup>b</sup>	1999
Survey Dates	6/21 to 7/7	6/19 to 7/19	6/18 to 7/20
Total Interviews	198	787	1,246
Completed-trip Interviews	85	666	448
Catch Rate	0.5	0.6	0.25
<b>Percentage of Angler-trips</b>			
<b>ANGLER TYPE</b>			
Guided	62	32	48
Unguided	37	68	48
Guide who is fishing			3
Unknown			1
<b>RESIDENCY</b>			
Non-Alaskan Residents	76	76	91
Alaskan Residents	24	24	9
<b>TACKLE TYPE</b>			
Spin	77	30	49
Fly	4	35	44
Spin and Fly		4	7
Spin, Fly and Bait <sup>c</sup>		<1	
Spin and Bait		30	
Bait	18	<1	
No Record	<1		<1

<sup>a</sup> Dunaway and Bingham 1992.

<sup>b</sup> Dunaway and Fleischman 1995.

<sup>c</sup> Use of bait was prohibited in 1998.



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## **APPENDIX A. SUPPORTING STATISTICS**

**Appendix A1.-Angler counts by day during the survey of the coho salmon fishery on the lower Kanektok River, 7-25 August 1998.**

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Date	Count
07-Aug-98	12
08-Aug-98	14
09-Aug-98	41
10-Aug-98	28
11-Aug-98	21
12-Aug-98	Scheduled off
13-Aug-98	Scheduled off
14-Aug-98	22
15-Aug-98	26
16-Aug-98	23
17-Aug-98	30
18-Aug-98	25
19-Aug-98	Scheduled off
20-Aug-98	Scheduled off
21-Aug-98	25
22-Aug-98	36
23-Aug-98	28
24-Aug-98	30
25-Aug-98	29

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**Appendix A2.-Angler counts by day during the survey of the chinook salmon fishery on the lower Kanektok River, 18 June-20 July 1999.**

Date	Count
18-Jun-99	25
19-Jun-99	43
20-Jun-99	30
21-Jun-99	41
22-Jun-99	55
23-Jun-99	Scheduled off
24-Jun-99	Scheduled off
25-Jun-99	62
26-Jun-99	57
27-Jun-99	61
28-Jun-99	65
29-Jun-99	46
30-Jun-99	Scheduled off
01-Jul-99	Scheduled off
02-Jul-99	65
03-Jul-99	54
04-Jul-99	54
05-Jul-99	51
06-Jul-99	44
07-Jul-99	Scheduled off
08-Jul-99	Scheduled off
09-Jul-99	34
10-Jul-99	39
11-Jul-99	56
12-Jul-99	43
13-Jul-99	40
14-Jul-99	37
15-Jul-99	33
16-Jul-99	15
17-Jul-99	20
18-Jul-99	24
19-Jul-99	17
20-Jul-99	20

**Appendix A3.-Cumulative catches  
(kept and released) of all fish caught by  
interviewed anglers during the coho  
salmon survey on the lower Kanektok  
River, 7–25 August 1998.**

Species	Kept	Released
Coho Salmon	900	4,965
Pink Salmon	7	780
Dolly Varden	0	351
Rainbow Trout	0	196
Chum Salmon	1	189
Chinook Salmon	0	64
Arctic Grayling	0	7
Sheefish	0	3
Sockeye Salmon	0	2
Humpback Whitefish	0	1
Round Whitefish	0	1

**Appendix A4.-Cumulative catches  
(kept and released) of all fish caught by  
interviewed anglers during the chinook  
salmon survey on the lower Kanektok  
River, 18 June–20 July 1999.**

Species	Kept	Released
Chinook Salmon	482	1,065
Chum Salmon	52	2,281
Sockeye Salmon	36	179
Dolly Varden	1	123
Rainbow Trout	0	117
Arctic Grayling	0	11
Coho Salmon	0	6
Arctic Char	0	2
Pink Salmon	1	0





## **APPENDIX B. COMPUTER FILES AND SOFTWARE**

## **Appendix B1.-Data files and computer programs used to produce this report.**

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### **Data Files**

V-000301i011998.dta	Angler interview data from 7 through 25 August 1998.
V-000301c011998.dta	Angler count data from 7 through 25 August 1998.
V-000301b011998.dta	Kanektok River coho salmon AWL data
V-000301i011999.dta	Angler interview data from 18 June through 20 July 1999.
V-000301c011999.dta	Angler count data from 18 June through 20 July 1999.
V-000301b011999.dta	Kanektok River chinook salmon AWL data

### **Analysis Programs**

BBX.SAS	A series of programs that use biological data files to produce tables of mean lengths and weights by sex and age group.
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